

# NY State Challenges Reactor Seismic Vulnerability; Investigates Biological Effects of 765 kV Lines

First of a series of articles concerning the interaction of man, electronics, and the environment

By Robert Sugarman

Just how little is understood or at least agreed upon about the interaction of man and his environment is being disclosed in two hearings, instituted in part by New York State, one at White Plains, the other at Syracuse.

The White Plains show-cause hearing before the U.S. Atomic Safety Licensing Appeals Board questions the seismic vulnerability of the three Consolidated Edison nuclear reactors at Indian Point, NY, some 24 miles north of New York City. At issue are several separate but simultaneous geological disputes concerning the maximum ground acceleration that could be expected at Indian Point in the event of an earthquake. Although the NRC feels that New York City's distance from Indian Point would make evacuation from the city unnecessary in any core-melt accident, seismic or otherwise, the issue is hardly academic. A worst-case finding that Indian Point is situated on an active geologic fault, the Ramapo, would almost certainly close the plants either on an interim or permanent basis.

## Activity Disputed

If the Appeals Board concludes that the site is not an active fault but nevertheless may be subject to ground accelerations greater than 0.15 G, the maximum claimed by Con Ed and NRC, then the final clearance granted to Indian Point number 2 and 3 reactors will certainly be re-investigated. (Indian Point reactor #1 was shut down by NRC in 1974, because it had no emergency core-cooling equipment to handle a core melt).

Westinghouse, the site reactor contractor, feels it has shaker-tested the prime safety (Class I-E) electrical equipment to forces several times 0.15 G and the NRC agrees. But the emerging art of seismic testing still leaves some doubt about the applicable frequency spectra of an earthquake, the particular effect of the soil at any given site, and G-factor amplification and attenuation of structures such as a control room that will house the equipment. Westinghouse, according to George Bohm, their reactor manager

of structure technology, places emphasis on shaker-testing, rather than theoretical testing of electrical motors, cables, relays and the like, because, unlike mechanical components like valves, their performance under shock isn't easily calculated. Another, practical reason is that they're small enough to fit in a shaker.

The Syracuse generic hearing on proposed 762 keV power-line runs from

Driscoll's feeling that those who can't get used to the noise should be reimbursed for moving.

As of this writing, however, Dr. Andrew Marino of the Syracuse V.A. hospital is to give testimony as to the possible adverse effects of high-voltage ac fields along the right-of-way.

Last year, Dr. Marino gave a then-unpublished memo to pharmacologist and environmental director of Hun-

they will, for example, light a fluorescent bulb. He points out that high local fields are not unusual, with 30 V/vm at the surface of an electric blanket and 3 V/cm at 10 cm distance from it. "But," he adds, "one possibility is that the three-phase lines, unlike the single-phase blanket, can induce rotation of any conduction elements in the nervous system, though the extent of this may not be known."

Somewhat more arcane are the hypothetical electro-shock incidents that might occur when a long tractor-trailer falls under a rural dirt road beneath the 762-keV lines. Rural roads are the worst case, since the lines aren't elevated for them as they are for city roads. Under these conditions, says Driscoll, "touching a long tractor-trailer might induce a field current of 6 mA or, for a school bus, 2 to 3 mA. This is less than the let-go threshold for an adult, but for a child, the threshold is 4.5 mA. So a child touching the vehicle, which fortunately would have to be longer than a school bus, might get a painful shock and not be able to let go, though it wouldn't be fatal. IEEE's Muller feels the accident would indeed be hypothetical. "You have to hypothesize," he says, "that the large tractor-trailer has insulated tires, which I believe are now conductive, that the truck is standing on dry ground, and that the rest of the ground is wet."

As for pacemaker malfunction near the lines, Driscoll says evidence at the hearings shows that the pacemaker may temporarily revert from asynchronous to synchronous operation, which could conceivably prove hazardous to some patients.

Summing up his position, Driscoll says, "It may be rash of me, but from what I've seen so far, and excluding the testimony on biological effects, which we'll examine in detail, I don't see why we won't grant the applications for the lines."

The reactor hearings, unlike those for the high-voltage lines, are concerned at this point with purely geologic findings not biological effects.

The most important question, whether or not the Ramapo fault is active, will not be easily resolved, according to NY State. Con Ed, which has hired consultants to make a seismological survey, claims neither of two NJ earthquakes, one of 2.5 R (Richter) on March 11 and 2.25 R on April 13, were along the fault system. Consultants also claim that the fault is not legally capable, which in NRC terminology means there has been no movement near the ground site for 85,000 years and none of a recurring nature for 500,000 years.

The NRC staff, according to counsel Tom Bruen, will support, as required by law, the Con Ed positions, since final licenses have been granted by the NRC. They will refute the CCPE position that peak site-acceleration should be increased one standard deviation to an increased value of 0.23 G. They will also refute the contention that the Cape Anne earthquake of 1755 is part of the Indian Point seismic zone, which would then increase the acceleration by CCPE (Concerned Citizens for the Protection of the Environment) calculation to a grand total of 0.4 G, arguing instead that that earthquake is related to a magma zone called the White Mountain Intrusives.

"One problem in the proceedings," explains Bruen, "is that on the East Coast, unlike California, we don't have any indication of surface faults except on the edge of a tectonic plate."

*"If earthquakes are reasonably correlated with the tectonic structure closest to the site...I don't see any reason to move it (the Cape Ann earthquake of 1755) all over New England..."* — NRC staff counsel Tom Bruen

Canada, one for the NYPSC for peak summer loads, with Con Ed a major user, and the other for Niagara Mohawk and Rochester Gas and Electric, covers both because, according to energy systems specialist Dan Driscoll of the Dept. of Energy Conservation, "I noticed slight discrepancies in the effects from the lines as described by both utilities."

While such lines have been built in California, Europe and Canada, many were constructed without past or present investigation of their biological effects, a fact confirmed in California by that state's Public Utilities Commission. Construction of high-voltage lines is covered by the National Safety Electrical Code of 1961, as revised in 1973. But, according to standards engineer Conrad Muller of the IEEE who heads the lines committee secretariat, while the code is due for a revision, 762 keV lines aren't to be included in the revision. The code does specify ground clearance, but no maxima for noise, ozone or electric fields.

The Syracuse hearings, in Driscoll's opinion, have shown the effects of ozone to be negligible (some 5 parts/-billion). The sound, about 60 dB in wet weather, may prove objectionable to residents along the right-of-way. It's

tington, L.I., Dr. Jeffrey Wenig, suggesting 1.5 V rms/cm as a maximum long-term exposure after observing a change in the serum protein of rats at 75 V rms/cm.

Wenig, who then opposed a 345-keV extension through Huntington of the proposed 762-keV lines testified as a pharmacologist to Marino's findings, including his own observation of the rats and their "runt-like" appearance. At that time, he also called in Dr. William Walter, research scientist of Polytechnical Institute of New York, who testified that the field at the edge of the right-of-way for the 345-keV line would be about 22 V rms/cm. Wenig recommended locating the line underground, but says the final decision will probably come out of the Syracuse hearings.

The effect of high fields on humans is probably less well-known, although the Russians, in the proceedings of the 1972 Conference on High Tension Systems, quote evidence of headaches, palpitations and other nervous disorders in switch-yard operators working with 500 to 750 keV gear.

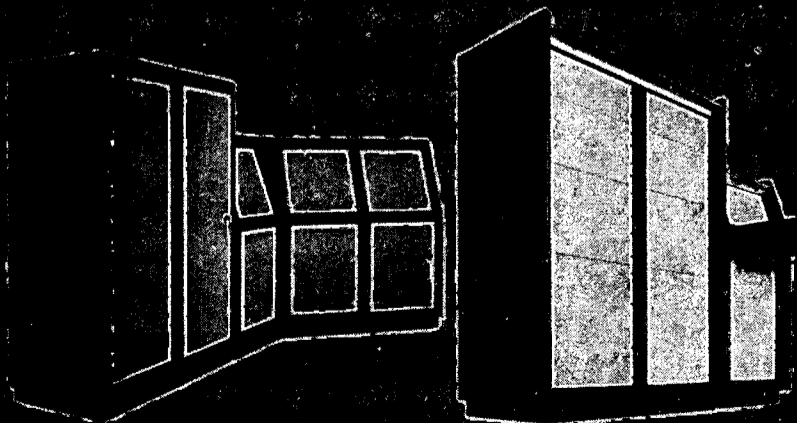
Driscoll feels that not too much is known about the 100 V/cm fields which, he says, may be experienced at the edge of the right-of-way, although

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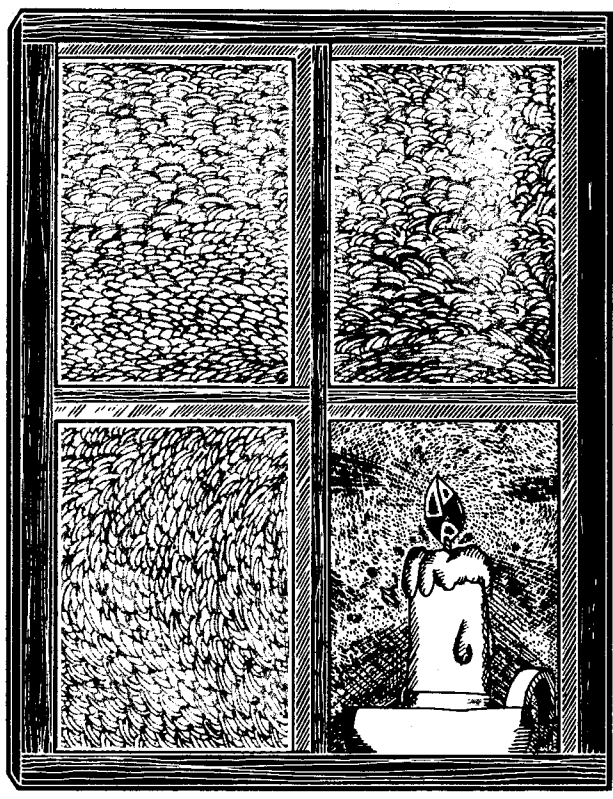
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